Habitat and Wildlife Monitoring Project
Draft Description of Methods and General Metadata

Initial experimental procedures:

Field surveys designed to gather the data in this database were initiated in August, 2001 in the Bogard area of western Lassen County in northern California. Experimental protocols were applied to 20 sample plot grids. Small mammal trapping was conducted on a few of the plot grids but discontinued due to cold weather. Remote sensing cameras were set at each of the survey areas. The intent of this early effort was to assess techniques and determine the feasibility of applying the protocols to landscape level sample areas. Data gathered during 2001 was used to help assess feasibility but because it was incomplete it is not stored in the database.

Sampling strategy in 2002

In 2002, the project was expanded to include all of the Southern Cascade Section M261D of the "Ecological Units of California" August 1994, United States Department of Agriculture, Forest Service and Natural Resource Conservation Service. Thirteen subdivisions of the Southern Cascade Section were considered sampling strata and were used to proportionally allocate a sample selection of 200 random points selected from a three mile map grid established across California using ArcView GIS. Sample points were selected for each of the 13 subdivisions in the Province based on acreage (a subdivision having 10% of the acreage received 200 x .10= 20 plots.).

Some of the plot locations selected were on private lands where permission to enter was not available. Preliminary surveys also indicated that some plot locations may not be accessible because of unsafe terrain. "Secondary" random points were selected within each strata. When a "primary" plot was not accessible, the nearest secondary plot that could be surveyed based on safety and permitted access was surveyed. Field personnel completed 63 of 200 plot locations selected for sampling.

Early in the field season, it became apparent, based on the time needed to complete a plot, that all the sites selected could not be visited during the field season. In an effort to achieve a reasonable distribution of plots, the crews moved within the survey area to distribute sampling effort throughout the Southern Cascades region.

Sampling strategy in 2003

Prior to the 2003 field season, the decision was made to repeat wildlife surveys on plots completed in 2002. This decision was based on the long term objectives of monitoring trends in wildlife species measured by the annual relative rates of occurrence. It was decided not to not repeat vegetative surveys annually but rather every few years because of anticipated slow rates of changes in habitats as opposed to relatively higher annual fluctuations in most wildlife species. Plots surveyed in 2002 were revisited in 2003.

Work during the revisits included, baited camera stations, small mammal trapping and breeding bird recordings. Habitat surveys were not conducted during the revisits.

In an effort to increase sample size and the distribution of plots, 50 new primary and 50 new secondary plots were selected for survey in 2003. In addition, funding was made available to expand the project easterly into the Modoc Plateau Ecological Unit due to increasing concerns about declining ecological conditions in the region. One hundred random plot locations (50 primary and 50 secondary) were selected from strata based on sub ecological units within the Modoc Province. Privately owned lands within the region were excluded from sampling using a landownership GIS coverage. Crews in the Modoc survey area also attempted to "proportionally distribute" sampling effort as the field season progressed.

The initial strategy was to develop a baseline of plots within the Southern Cascades and the Modoc Plateau and then continue to monitor these plots annually. Wildlife surveys (small mammal trapping, breeding bird recordings and baited camera stations) would be repeated annually and vegetation sampling would be done every fifth year. This was initially viewed as a repeated measure design.

Following the 2002-03 field seasons, meetings were held with Department of Fish and Game (DFG) personnel from the Resource Assessment Program (RAP) and a DFG statistician. In hindsight, it's evident that attempting to maintain plot distribution by moving the crews throughout the study area was inappropriate. A preferable approach would have been to select sub-samples from within each of the strata to maintain a proportionally allocated, but smaller random sample.

Future sampling strategy:

Personnel from Wildlife Programs Branch in the NCNCR met with Resource Assessment Program staff and a DFG statistician to discuss the project and review sampling methodology. Wildlife Programs personnel were advised to abandon the plan to establish a baseline sample of plot locations that are repeated annually. It was recommended that an independent random sample of plot locations (3 mile grid intercepts) be selected annually. All plot locations selected in a given year will be sampled regardless of whether the plot had been selected and surveyed in previous years. Sampling will continue to be stratified by a proportional allocation (acreage) of the sample to ecological subunits.

As of December, 2003, the issue of selecting plots each year as the season progresses has not been resolved.

Locating and marking survey plot grids.

Sample location coordinates are downloaded from ArcView to text files and uploaded to global positioning units (GPS). Field maps with plot locations are printed and used to guide personnel to the vicinity of the plots. Field crews navigate to the plot location using

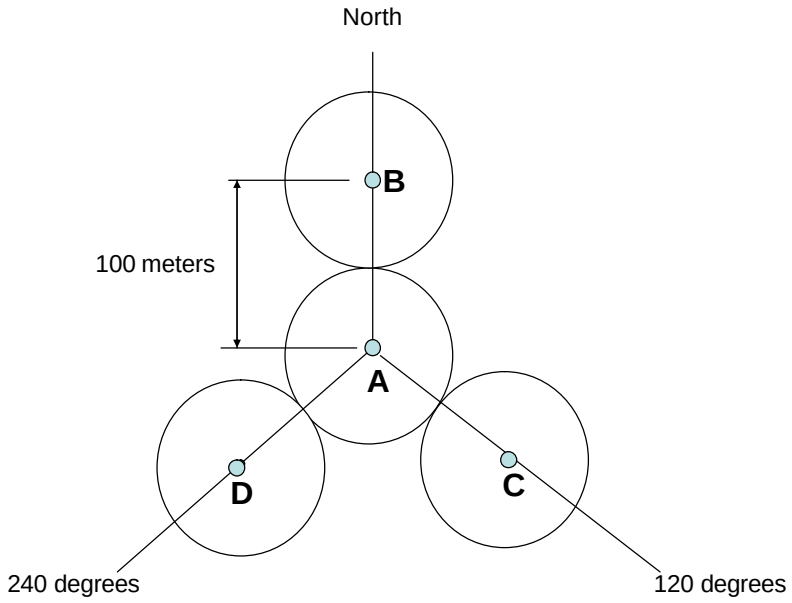
a GPS unit. The location of the plot grid center is established the first time the "distance to point" feature on the GPS indicates "0".

Plots are temporarily marked with colored flagging. A permanent plot grid center is established by driving a capped, 12" by ¾" threaded pipe into the ground. The rounded cap is left slightly above ground level. This is done to aid in locating the exact point for future surveys using a metal detector.

Establishing Plot Grids

The independent sample unit consists of four 50 meter radius circular plots and is referred to as a plot grid. The grid center is located at the selected random point and is marked with the pipe. The sample plot grid configuration was patterned after the U. S. Forest Service's Forest Inventory Analysis (FIA) described in **Field Instructions for the Annual Inventory of Oregon and California, 2001**. The center of plot B is located 100 meters north (magnetic) from grid center (plot A). The center of plots C and D are located 120 and 240 degrees, respectively from grid center. Plots B, C and D are flagged during field surveys but they are not marked permanently with pipe.

Four plot Sampling Grid

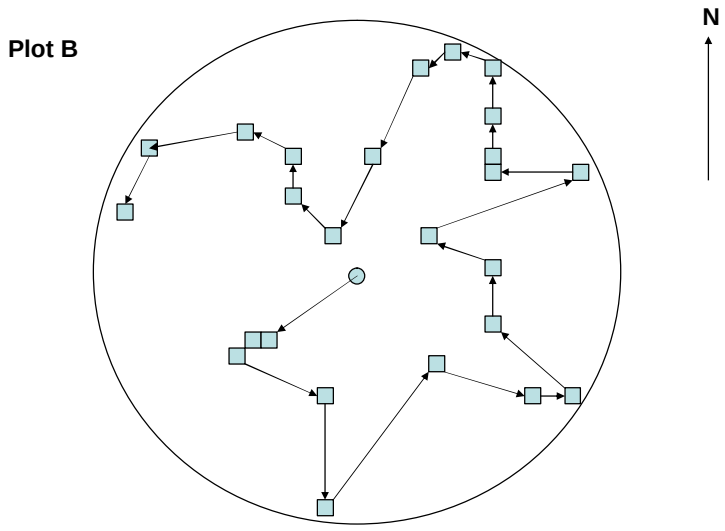


Vegetative surveys

Vegetative surveys were designed to gather information to allow classification of habitats to CWHR (California Wildlife Habitat Relationships program) types, tree size and percent canopy closure. Habitats are classified as either “wooded” (having 10 percent or more tree crown canopy) or “non-wooded (less than 10 percent canopy). Trees having diameter at breast height (dbh) less than 5” are not recorded as trees except when they occur as a “layer” element.

Each of the four plots in every plot-grid has 25 randomly selected habitat assessment points. These points were established by drawing a 50 meter radius plot on grid paper to scale. Each square (scaled at 5 x 5 meters) on the grid paper was numbered chronologically. Twenty five random numbers were selected without replacement to select sample locations. Bearings and distances to nearest points (approximate centers of selected grids) were determined using a protractor and scale. This procedure established a route allowing field personnel to pace along the established bearing to sample points. Each of the four plots have unique sample point distributions.

Twenty five point sampling route for vegetative surveys (plot radius 50m)



Vegetation sampling procedures

Wooded habitats: Areas having greater than 10 percent tree canopy. (use only the wooded habitat survey form).

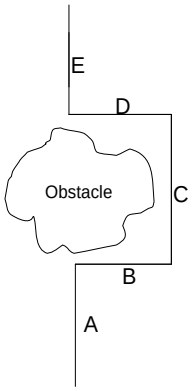
Ground cover:

Habitat data are gathered by two person teams. After the center of the sample grid is located and marked, a hand held compass is used to site the bearing to sample point one. One observer paces the appropriate distance along the sighted bearing. The dominant ground cover feature in a 4” diameter circle is recorded at the “toe-point” of the last pace. Recorded ground cover features are:

Code	Feature
B	Bare ground
R	Rock
D	Duff (non structured decaying matter less than 1 inch diameter.)
SS	Small slash (residue 1-3” diameter)
LS	Large slash (residue 4 - <10” diameter)
LM	Log, medium (residue 10 to 20” diameter)
LL	Log, large (residue > 20” diameter)
Ang	Annual grass
Png	Perennial grass
F	Forb

When multiple features occur at the toe-point, the observer records the feature that occupies the largest portion of the 4 inch circle.

An offset pacing method is used when an obstacle is encountered between sampling points. The distance between sample points equals lines A + C + E. Lines B and D are equal in length



In addition to ground cover, other data recorded at each sample point are:

Tree species- The nearest tree from each sample point having a dbh of 5 “or greater is recorded. The first two letters of the genus and species identify the species. (e. g. Jeffery pine, *Pinus jeffreyi* is entered as pije.) Tree species codes are listed on the data form.

Diameter at breast height- The dbh of the nearest tree to each sample point is measured to the nearest inch using a Biltmore stick.

Layer – The presence of any shrub or tree with a dbh < 5” occurring in a 4” diameter “cylinder” visually extended above the ground at the sample point is recorded as a “layer”. The first two letters of the genus and first two letters of the species are used to identify the shrub or tree. “Shrub” or “tree” is entered to indicate an unknown species.

Height- (refers to height of layer element) Entries include 1, 2 or 3

1 indicates a prostrate (or seedling) shrub or seedling tree less that 6’’ high.*
2 a shrub or tree greater than 6” but less than 1 meter high.
3 a shrub or tree greater than 1 meter high.

* note: prostrate or seedling shrubs or trees (< 6” high) should not be considered as a functional layer habitat element.

Sight tube- a hand leveled vertical sight tube is held above the sample point and a “1” is recorded when the dot in the tube covers any part of a tree. A “0” is recorded when no tree canopy is intersected by the dot.

Non Wooded habitats: areas having less than 10 percent tree canopy.

(Field personnel must make an initial visual assessment of the plot to determine whether to survey as a wooded or non-wooded plot. Use only the non-wooded survey form.

Ground cover:

The same toe-point pace procedure used in wooded habitats is used when surveying non-wooded plots. Transects and survey point locations within plots are also the same.

Ground cover classes in non-wooded plots are:

Code	Feature
Four letter code	shrub
B	bare
R	rock
D	duff (decaying matter < 1” diameter)
SS	small slash (residue 1” to 3” diameter)
LS	large slash (residue 4” to 10” diameter)
LM	log, medium (10” to 20” diameter)
LL	log, large (>20” diameter)
Ang	annual grass
Png	perennial grass
F	forb
GS	ground shrub <12” in height

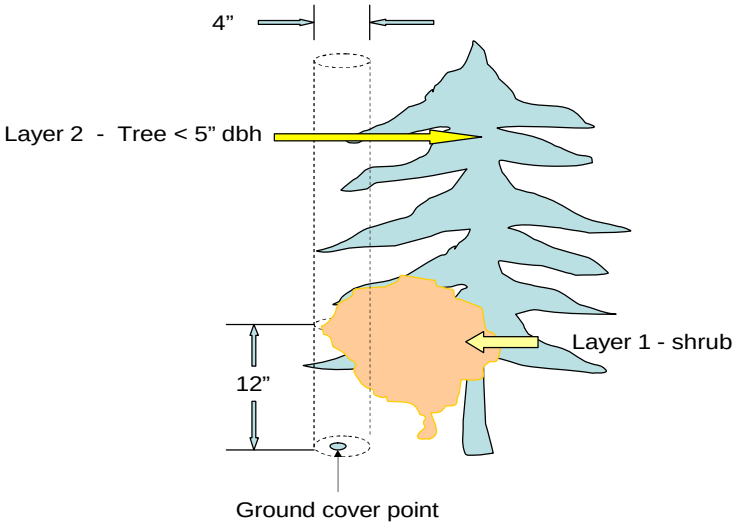
Size class- For Ang (annual grass), Png (perennial grass), F (forb) record "1" for size class when feature is less than 12" in height. Record "2" when equal to or >12" high. Record a shrub as ground cover when any portion of the shrub is the dominant feature in a four inch diameter "visualized" cylinder extended 12" above the ground at the survey point. A shrub is not considered ground cover if any portion of the shrub extends more that 12" above the ground. A shrub (or tree < 5" dbh is recorded as a layer when it extends more than 12" above the ground within a 4" diameter circle, visually extended above the plot.

Record the following size classes when:

Size class	Form	Percent crown decadence
1	Seedling shrub or tree	none
2	Young shrub or small tree <5"	none
3	Mature shrub	1 to 25%
4	Decadent shrub	>25%

Layer 1 - A shrub, or tree less than 5" dbh is recorded as a layer when any portion of the crown vegetation extends into a 4" diameter circle "visually" extended above the ground cover survey point. To be considered a layer, the shrub or tree <5" dbh, must have a portion of it's crown extending into a 4" diameter "visual cylinder" in any portion of the cylinder that is > 12" above the ground.

Layer 2 - A second layer is recorded when vegetation (either a shrub or tree < 5" diameter extends into the 4" diameter "visual cylinder" above the vegetation recorded as layer 1.



California Wildlife Habitat Relationships (CWHR) – Vegetative Habitat Elements

Special habitat elements are defined in “A Guide to Wildlife Habitats of California” K. E. Mayer, W. F. Laudenslayer Jr. Editors.The importance of these elements to wildlife species varies from none to the elements being essential to presence of some species. Species experts have rated the relative importance of these elements to wildlife by defining dependency on an element at three levels; “***essential***” signifies that the element must be present for a species to be present; “***secondarily essential***” indicates that the species is considered dependent on the element but can occur if the element is absent by the presence of a secondary element that serves the same functions as the essential element; a “***preferred***” level of dependency indicates that the species utilizes the element at a level greater than its relative abundance and the habitat is enhanced by the presence of the element, but the species does not require the element.

Observed versus Calculated Element Occurrence.

CWHR vegetative habitat elements can be separated into two categories based on whether the element is considered to be present with a single occurrence (eg. graminoids or when there is a quantitative level required for occurrence (e.g. shrub layer) where shrubs must occur in a tree type at a level of at least 10% cover.

Observed elements (these elements are recorded as present based on a single occurrence).
Acorns
Aquatic emergent
Aquatics submerged

Cones from gymnosperm trees
Forbs – herbaceous dicotyledons
Graminoids – grasses
Litter-residue <1" diameter
Moss-bryophytes
Shrubs
Slash, large (rotten) – residue 3-10" diameter
Slash, large (hollow)- residue 3-10" diameter
Slash, large (sound) – residue 3-10" diameter
Slash, small residue 1 - 3" diameter
Tree, broken live top > 11" diameter
Tree or snag with cavity
    Small <2" diameter
    Medium 2-6" diameter
    Larger > 6" diameter
Tree with loose bark
Trees, fir >11"dbh
Trees, hardwood >11"dbh
Trees, pine >11" dbh

Calculated elements:
Layer, Shrub > 10% understory ground cover in a tree type
Layer, tree > 10% subcanopy trees
Layer, Herbaceous > 10% understory ground cover in a tree type
Shrub/agriculture interface
Shrub/grass interface
Shrub/water interface
Tree/grass interface
Tree/shrub interface
Tree/water interface
Tree/agriculture interface
Grass/agriculture interface
Grass/water interface

After completing the vegetative surveys at a plot in a sample plot grid, the field crew records whether the vegetative elements listed as "observed" above were found on the plot. These determinations are made immediately after each plot is completed. An element is recorded as "observed" when one or more observations of the element is made.

The determination of the presence of the "calculated' elements are based on the following criteria.

Layer, Shrub > 10% shrub understory as a layer in a tree type – considered present on a plot when 3 or more of the 25 ground cover points were observed to have a shrub of size class 2 or 3 occurring as a layer. Considered present on the grid when 11 or more of the 100 ground cover points in the 4 plots were observed to have a shrub of size class 2 or 3 occurring as a layer.

Layer, tree > 10% subcanopy trees – Algorithm to be developed.

Layer, Herbaceous > 10% understory ground cover in a tree type- considered present on a plot when 3 or more of the 25 ground cover points on a plot were observed to have annual grass, perennial grass or forbs as the dominant feature at the point. The element is considered present at the grid level when 11 or more of the 100 points were observed to have annual grass, perennial grass or forbs as the dominant feature at the point.

Note on interface elements: Interface elements are considered only at the plot grid level.

Example: Shrub/agriculture interface – The element is considered to be present on the plot grid when one or more of the plots are found to be a non-tree, shrub type and one or more plots are determined to be an agricultural type.

The interface elements listed below are considered present on the plot grid when at least one of the four plots in a plot-grid is classed as one of the interface types and at least one is determined to be the other. More than one interface element could occur on a plot grid. For example, when one plot was determined to be a shrub type, one a grass type and the other two plots were classes as tree dominated, both tree/shrub and tree/grass interface elements would be recorded as present.

Shrub/grass interface
Shrub/water interface
Tree/grass interface
Tree/shrub interface
Tree/water interface
Tree/agriculture interface
Grass/agriculture interface
Grass/water interface

Counted habitat elements: Logs, snags and stumps are counted in each plot on each plot grid. Logs and snags of various size and condition classes and stumps (snags less than 10 feet in height) are counted within a 25 meter radius around each plot center. These elements are listed with a “tally” section of each CWHR habitat element check list form for each plot.

One member of the field team stays at the plot center and records numbers of elements counted by the other team member. The counter circles the plot center at approximately 15 to 15 meters from the recorder located at the plot center. Counts are given to the recorder as the counter moves through the plot. When an element is observed near the outer perimeter of the plot, the counter moves to the element and sites back to the recorder located at the center of the plots using a rangefinder to determine the distance. Elements that are 25 meters or less from the plot center are tallied.

Small Mammal Trapping:

California's Wildlife, Volume lll – Mammals, Editors D.C. Zeiner, W. F. Laudenslayer Jr., K. E. Mayer and M. White. April, 1990. was used to identify species likely to be found in the Southern Cascades and Modoc Plateau Ecological Units based on range maps for each species. Those species having limited range or described as occurring at the edges of the survey units were identified as "restricted". In addition, the species list for each ecological unit was reviewed by small mammal experts from the California Department of Health Services office in Redding, California.

Hiring procedures for field personnel include oral interviews to assess applicant's experience and training in trapping, handling and identification of small mammal species. Personnel are assigned work partners (two person teams) based on experience and ability.

Personnel are given a species identification training course by California Department of State Health Services biologists-Vector-borne Disease Section. Training is facilitated by use of a complete specimen collection and the field personnel are provided with a series of species identification keys. In addition, employees are provided safety training to avoid hanta virus.

When species identification is in question, digital photographs are taken or the specimen is euthanized and examined by experts.

In 2003, Department of Fish and Game employees met with representatives of the Museum of Vertebrate Zoology at the University of California, Berkeley. Museum staff offered to provide additional training and suggested consideration of ear clipping to collect tissue samples for archiving and potential DNA analysis. This procedure will be considered prior to the 2004 field season.

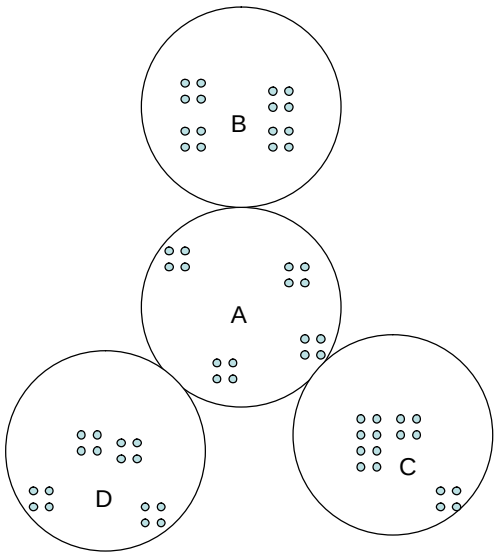
Trapping procedures:

Traps: Collapsible Sherman live traps are used for capturing small mammals. The traps are 9" x 3" x 3" with both end folding inward to allow the trap to be collapsed and folded for storage.

Bait: a mixture of bird seed, oatmeal and peanut butter is used. Meal worms are added to provide forage for shrews. Approximately a teaspoon of bait is used with each trap along with two or three (1" diameter, approx.) cotton balls for thermal cover.

Establishing trap locations: Traps are set in grids of four, 10 meters apart. Each of the 50 meter radius plots making up the four-plot grid had 16 traps in four grids of four traps each. Trap locations were selected randomly by picking a random starting point in each quadrant of each of the four plots (A, B, C and D) in a grid. These points were established by drawing a 50 meter radius plot on grid paper to scale. Each square (scaled at 5 by 5 meters) on the grid paper was number chronologically. One random number was selected for each of the four quadrants in each plot (A, B, C and D.) From each of these initial points a randomized process was used to choose the additional 3 points for each grid.
Bearings and distances from the center of each plot to each point on the trap grids were estimated using a compass protractor and scale.

SMALL MAMMAL TRAP GRIDS



The bearing and distance to each trap grid is listed on the small mammal trapping form. Field personnel use a hand held compass from the center of a plot to determine direction and then pace along the compass line to the first point on the trap grid. A baited trap with cotton balls is set at the "toe point" when the appropriate number of paces are made.

From the first trap, a bearing is taken and the next trap is set at a toe point 10 paces away on the appropriate compass bearing. The process is continued until the grid is completed.

Note: During a presentation of the monitoring program at the Museum of Vertebrate Zoology, Univ. Cal Berkeley, there was discussion about selecting specific sites for each trap. It was noted that placing a trap at the random location without consideration of the structural cover and foraging elements likely to be used by small mammals, would tend to minimize trapping success. However, objectives of the monitoring program include assessing the overall habitat suitability of the sample plots along with evaluating long term trends in populations. Therefore, it may be argued that going to a random point and placing the trap at the nearest "preferred" habitat condition subjects the process to bias. There was a discussion about establishing a process that allowed setting the trap at the "best" location within some relatively small distance (e.g. 2 or 3 meters) from the toe point. During 2002 and 2003 field seasons, personnel were instructed to place traps as close to the toe point as possible while attempting to provide shade. This issue should be resolved prior to the 2004 field season.

Traps are set as late in the afternoon as possible and are checked and picked up the following morning prior to 10:00 am.

Specimens are places in plastic bags for observation and measuring. Both personnel must agree on the species identification. If there is doubt about the identification, measurements and detailed descriptions are taken along with digital photographs. In some cases the animal may be euthanized for examination at the State Department of Health Services Lab in Redding. Consideration will be given to taking ear clips beginning in 2004.

All traps that contained an animal are placed in a large plastic bag and returned to base camp for a Lysol spray treatment for safety.

Baited Camera Stations:

Motion activated 35 mm cameras are being used to assess the presence of wildlife species that may be attracted to bait. The camera unit used is made by Moultrie Feeders company. The unit consists of a camera and battery contained in a rain protected container attached to a metal bracket for mounting on a tree or post. The camera is mounted at breast height on a suitable tree as close as possible to the grid center (center of plot A). The bait is attached to a suitable tree near the camera. Distance from camera to bait tree is usually between 10 and 20 feet. The unit is equipped with a delay feature that allows the camera to activate only once during a selected time period to avoid multiple exposures during a single visit. The delay time used is 10 minutes.

In 2002, bait used was a single can of sardines nailed at approximately breast height on a tree. The lid of the bait can was opened slightly. This method was used during the first full survey year in an effort to minimize the weight of equipment that field personnel were required to transport to each plot. In 2003, chicken and a commercial scent

attractant (brand name – “gusto”) was added in an effort to attract a wider variety of species to the cameras. Approximately, one half of a chicken was attached to the bait tree held by poultry wire and nails.

Cameras were left at each station approximately 2 weeks. Exposed film was developed and reviewed to identify species. Each photograph with wildlife was scanned and stored in a computer database.

Breeding Bird Tape Recording Surveys:

Timer activated tape recorders are placed near the grid center (center of plot A) at each randomly selected plot. Marantz recorders (model pmd101) are activated by a sprinkler timer (brand name Orbit) wired to the recorder. An omnidirectional microphone (brand name “boundary” by RadioShack) was used. The recorder and timer were placed in a Rubbermaid container for protection. The microphone was placed on the lid of the container. The microphone cord exposed outside the closed container was protected to prevent damage from chewing rodents.

The system used in 2002 was limited to only two time periods. The timers were set to activate the recorder at one half hour before sunrise for a 5 minute recording period and then reactivate at sunrise. This resulted in two, five minute monitoring periods. In 2003, Orbit timers with four periods were used to extend the survey periods. The start times for the five minute periods sampled were

1. One hour before sunrise. This period is designed to monitor nocturnal species, particularly owls.

2. One half hour before sunrise.

3. Sunrise (periods 2 and 3 duplicate the periods sampled in 2002).

4. One half hour after sunrise.

Field personnel determined sunrise time each morning using Garmin gps units that provide daily times. Start times on the timers were adjusted every few days to account for change. Sampling was conducted during the month of June.

Tapes are being reviewed by expert bird call interpreters using digitized wave files that allow tapes to be played while simultaneously displaying a visual digital rendering of

time and frequency. Species identifications will be summarized by survey plot number, date, and time period.

Digital Habitat Photographs:

Eight digital photographs are taken from grid center (center of plot A). Equipment used provides moderate to high quality digital photographs. The photographer stands directly over the marked (galvanized pipe in ground) plot center and used a handheld compass to locate magnetic north. A land feature (tree, shrub, rock ect.) is located in relation to the north bearing and the feature is used to center the camera when taking the photograph. This procedure is repeated at NE, E, SE, S, SW, W and NW directions resulting in a total of eight photographs for each plot grid. This procedure is repeated each year for each plot.

The photocard is placed in a letter size envelope with all the data sheets. The card remains with the data until it is entered into the database and the photos are downloaded and identified with the plot number. The card is then cleared an made available to the crews for the next field week.

Data entry procedures:

Field crews report to the NCNCR regional office on Monday morning to gather equipment, pick up vehicles and go the field. Crews work 4, ten hour days and return to Redding each Thursday afternoon with completed data sheets. A part time data entry person is hired each field season. All data are entered into an Access data entry system at the NCNCR office of Information Services Branch at the Cantera office in Redding. All digital photographs taken at each grid center are downloaded and the photo cards are cleared and returned to the Redding office for use the following week.

Illegible or incorrect data entries are noted on the data sheets each week by data entry personnel. Data entry and field crew personnel meet at 0800 hours each Monday morning to review and correct data questions.